

Native American Technology and Culture

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Abstract

Principals in schools serving Native Americans have a unique role as technology leaders. They must be cognizant of digital demands, government demands, as well as cultural demands. Over the 2004-2005 academic year the researchers conducted pilot interviews of Native American principals on 4 distinct Native American Reservations to explore issues of technology leadership, cultural views of technology, and the use of technology to maintain tribal culture. The researchers interviewed to determine issues of funding, access, use, leadership skills, and cultural adaptations. Often, policy makers view technology and tradition as a dichotomy. In this paper, the researchers detail common themes and actions of various technology leaders serving Native American students. It was determined that access in these Native American schools far exceeded our hypothesis that these rural, reservation areas would be most impacted by the digital divide. Further, it was concluded that for the schools in this pilot, tribal culture is being facilitated through technology. It is concluded that in these schools, technology training and funding were issues of most importance.

Technology Leadership in Indian Country

The literature on Native American leadership often discusses leadership as a lacking resource in Indian communities without detailing what leadership looks like and the constraints on Native American leadership in their daily role. The intersection of Native American leadership and technology is a missing area of investigation in the literature. In an educational context Anderson and Dexter (2000) found “technology leadership has a significant and positive correlation with each of the dependent variable” which includes: integration of technology in teaching; network and Internet utilization; and student use of application tools (p. 15). Looking at leadership in Indian Country and technology in Indian Country will provide a basic understanding of this area of investigation.

It is optimistic to see that some authors are increasingly detailing grassroots efforts to instill leadership values in Native Americans. Lee (2003) discusses efforts to develop skills of

Native American leaders through the Tribal Resource Institute in Business, Engineering, and Science (TRIBES). This initiative is a unique, rigorous, curriculum hosted on the campus of the University of New Mexico. The objective is to teach Native students entering college how to become leaders in their communities. Wakshul (1997) describes how in 1990, the founder and president of Americans for Indian Opportunities (AIO), LaDonna Harris, worried about the “lack of Indian leadership necessary to successfully propel tribes into the new millennium” (p. 4). Out of this concern, the American Indian Ambassadors Program: Medicine Pathways for the Future initiative was developed. Based on cultural values of relationships, responsibility, reciprocity, and redistribution, this initiative seeks to groom and support Native American leaders.

Wakshul (1997) claims that leadership in Indian Country differs from leadership in the mainstream world. Native American leaders must know the values and history of both their traditional community as well as the mainstream community; be holistic while valuing interconnectedness; and belong to a communal society that accommodates tribal and mainstream systems that involve Natives and non-Natives. McLeod (2002) emphasizes these differences, but also claims leadership needs in Indian Country often intersects with leadership theory such as that developed by Peter Senge and Margaret Wheatley. McLeod concludes by saying “tribal leadership is the embodiment of a lifestyle, an expression of learned patterns of thought and behavior, values, and beliefs. Culture is the basis; it formulates the purpose, process, and ultimately, the product” (p. 13). In other words, leadership in Indian Country balances modern thought and traditional culture. To understand Native American leadership, researchers must research community members themselves.

In 2002, the Center for Cross-Cultural Studies out of Alaska University Fairbanks published “Guidelines for Culturally Responsive School Boards.” This document offers

guidelines for K-12 leaders in Native American communities. This document fails however, to look at constraints imposed by culture or benefits offered by modern digital technology. This document fails to address how technology can help leaders in Native American schools achieve these goals. When discussing the roles of principals and teachers, this report claims these leaders must “provide accurate information regarding all aspects of school performance...[and] utilize multiple indicators of assessment” (p. 9). In regards to technology, this statement seems to hint that Native American schools should adopt data-driven decision-making processes and technology that supports this practice. The North Central Regional Educational Library (2005) describes data-driven decision-making as:

The ability to track individual student performance, aggregate and disaggregate data easily, and use sophisticated and high-speed data-collection systems present a new host of options for using and interpreting data. Fear and mistrust of data are giving way to a new culture of use in which teachers and administrators routinely collect and analyze student data to achieve goals. (p. 1)

Although Alaska University Fairbanks (2002) did not mention this technology leadership tool, it appears to be a digital tool that falls in line with these culturally responsive guidelines.

Byrom and Bingham (2001) claim administrators are “the single most important factor affecting schools’ successful integration of technology” (p. 4). Manette (2004) believes that “if we can close the technology or, ‘digital,’ gap in our [Indian] communities, we have a powerful tool for closing all of the other ‘gaps’ we face” (p. 26). Manette (2004) emphasizes that technology can provide power that ignores constraints of geography and history; but it requires leadership. It is hypothesized that Native American leadership begins with the school principal.

Technology in Indian Country

In 1995, the Congress of the United States through the Office of Technology Assessment published “Telecommunications Technology and Native Americans: Opportunities and Challenges.” This report details opportunities for Native Americans to use telecommunications (defined as computer networking, videoconferencing, multimedia, digital and wireless technologies) in the realms of culture, education, health care, economic development, and governance. The report claims that technology:

Offers considerable potential to help Native Americans reestablish and strengthen their cultures. It offers new opportunities to save endangered Native languages, including traditional stories and histories, and to perpetuate language with new educational software and greater opportunities to converse with other Native speakers. (p. 17)

This report points out a remarkable interest in Indian Country for the development of telecommunication. It claims two possible future scenarios for Native Americans: Optimistically, technology can be used

1) to create jobs in Native-owned telephone, computer, broadcasting, and related companies; 2) market Native-produced arts and crafts electronically; 3) develop and promote tourist and recreational activities on or near Native lands; 4) provide expertise and competitive skills to Native entrepreneurs; 5) provide infrastructure for business startups in Native areas; and 6) manage Native land and natural and financial resources. (p. 6)

Pessimistically, it is also possible that due to “the lack of infrastructure, leadership, planning, funding, and policy...many of the rural, remote Native areas are left on the sidelines of the telecommunications revolution” (p. 6).

The Office of Technology Assessment claims that by using digital technology, “culturally sensitive social service institutions would... benefit from readily available cultural materials, such as traditional healing research or genealogical information systems” (p. 18). However, digital technologies could exacerbate ongoing cultural problems, such as: continuation of negative stereotypes of Native peoples; non-Native Americans posing as spiritual leaders and elders in public forums; and the difficulty of protecting sacred information, such as sacred sites of worship and rituals, from both the general public and unauthorized community members.

Warner (1998) claims that ethical issues such as access and stereotyping are pervasive when talking about technology use in Indian Country. To avoid passive learning behaviors through the use of technology, the author stresses the need for professional development. Monroe (2002) takes Warner’s (1998) position further by cautioning that technology may degrade traditional tribal cultures. She warns that Native American have always adopted new technologies and always at the cost of diluting ancestral ways. Further she warns that the geospatial-less orientation of the Internet may harm the terrestrial based identity of many Indian peoples.

Contrary to Monroe’s (2002) warning, the Office of Technology Assessment (1995) found:

Computer and communication technologies are revolutionizing the ability of Native Americans to record, develop, and share cultural resources. Native activities, traditions, sites, and sounds can be stored on videotape, videodisc, and CD-ROM; transmitted by radio waves, copper telephone lines, and fiber optic cables; played by radio, TV, or computer monitor. New electronic works of art that reflect and inspire Native cultures are possible in multimedia formats. (p. 27)

This report further details issues of community building, sovereignty, telecommunication policies, and policy frameworks. The report calls for grassroots empowerment, Native leadership, integrated infrastructure, Native entrepreneurial activity, interagency funding,

creating policy that considers self-determination and strategic partnerships, and more research and evaluation of policy and programs.

Yawakie (1997) uses the “Telecommunications and Technology” report to put a call for infrastructure development. She states that telephone penetration rates of Native American families are extremely low. Berg and Ohler (1991) discuss how distance education is being used to create a new educational paradigm for American Indians. Reasons for turning to technology include gaining skills to compete in mainstream culture; maintaining traditional knowledge or blending it with contemporary understanding of the world; strengthening Native cultural identity; organizing across tribal lines; sharing Native cultures; and teaching non-Natives about Native culture.

Recent developments may be shifting the picture of technology saturation on Native American reservations. Monroe (2002) discusses the recent enthusiasm of reservations to embrace digital technology and sees two important patterns. First, digital technology is becoming increasingly used at the tribal government level. Second, schools serving Indian majority students favor using multimedia and presentational technologies. Monroe (2002) sums up by saying “technological innovations undoubtedly dilute ancestral ways, but adaptations and change are also part of many Indian belief systems” (p. 295). The issue of dilution and adaptation is a focus of this research study.

Method

This study grew out of the researchers’ desire to better understand how principals serving Native American students were meeting the technological needs of the students and their community that inevitably exist in a digital world. Three guiding questions support this study: (1) What challenges exist for principals of Native American schools and how do these challenge impact technology policy in Native American schools? (2) Do cultural differences exist in Native

American schools that impede or facilitate the adoption of digital technology? (3) What does technology leadership look like in Indian Country?

Participants

Participants for this pilot study were 4 principals in schools serving Native American students during the 2004-2005 school year. The population is 185 schools funded through the Bureau of Indian Affairs (BIA). The BIA (2005) claims 120 of these schools are tribally controlled through a contract or grant (p. 2). The 2005-2006 school year data shows that these 185 schools served approximately 60,000 students in grades K-12 (Bureau of Indian Affairs, 2005, p. 1). The geographical diversity of this study can be summed up in the words of the BIA (2005):

One can visualize this wide-geographic spread by watching the sun rise on the Passamaquoddy reservation, the first stream of daylight to touch the United States on the east coast of Maine and then watching the sun set on the Quileute reservation, the last stream of daylight to touch the United States on the west coast of Washington. (p. 1)

Participants were chosen according to geographic region as defined by the United States Census Bureau (2005). The researchers wanted participation from each geographic region represented in this study. The researchers conducted two rounds of recruitment, inviting eight principals to ensure equal geographical representation. In each round of recruitment, the researchers used a random number generator to choose one school from each region: Northeast, Midwest, West, and South. This report details the return rate of 50%. However, further interviews are planned in the near future.

Data Collection

The researchers employed qualitative methodology as defined by Berg (2004) and Bogdan and Biklen (1992). By using guided telephone interviews, lasting roughly forty-five minutes each, the researchers attempted to understand the principals as well as their unique

social settings. For example, the interview questions were largely open-ended yet the structure was rigorously maintained for each participant. The guiding questions were not intended to be answered, but were rather used to focus the discussions for the researchers to gain a more in-depth, robust picture. It is accepted that a sample of 8 principals with a return rate of 50% is a small proportion of the 185 schools. However, we felt that a small, geographically divided, random sample was an effective way to fully explore the guiding questions. Note however, that the return rate will increase as scheduled interviews are completed in the near future. If time and resources permitted, a study inviting a larger sample of principals in Native American schools throughout the United States would have been conducted. *To date, we have had only one refusal to participate, data from one interviewee has yet to be included, and two principals have yet to confirm or refuse their participation.*

Findings

In this study, four technology leaders currently serving as principals in Native American schools were asked to participate in telephone interviews. Questions in the interviews dealt broadly with issues of: school demographics; technology in the school; technology funding; technology access; challenges of technology leadership; and the intersection of technology and traditional culture. The data was continuously analyzed between interviews to create what Merriam (1998) calls “parsimonious and illuminating” data (p. 162). The researchers used NVIVO software to aid in analyzing the data according using what Merriam (1998) calls the constant comparative method. The transcripts of the interviews were analyzed for distinct ideas and grouped into categories based on frequency, importance, as well as individuality. The following sections describe the individual schools and detail major themes along with specific examples.

School Description

The school located in the South is a large K-6, grant school serving over 600 students and having a staff of 140 members with three administrators. It is located in a rural community. This reservation hosts a gaming casino. This school had 1 to 5 computers in each classroom, 25 smart boards, full-time computer teachers, and keyboards using the indigenous language. This community has good technology saturation. The school serves as the technology center where individuals from the community regularly use the facilities after hours. The local high school utilizes distance learning. Community college students are each provided with a laptop. This community is in the process of laying a fiber optic system that will link 4-year colleges with the community college. Currently, the reservation hosts its own cable network that provides Internet access to the area including this school. The principal claims that technology access is adequate in this school. The principal has 5 years experience as an administrator with a years experience at this school. He has been an educator for 31 years. He is a Caucasian who holds a doctorate degree.

The Midwest school is a small, K-8, grant, day school educating 120 students with a staff of 15. The school is quite rural being about an hour from the nearest town. This school has a technology plan that is revised every five years. The school has 4-8 computers in each classroom with a full range of software options along with a computer lab. The principal claims the student-to-computer ratio is about 2:1. This school serves as the media center for the community and is probably ahead of the local college in regards to technology access and use. The school hosts GED, adult education, as well as community education course. The general community can use the technology resources of this school, but it is noted this an underutilized resource in the

community. The principal has 15 years experience in education and 9 years experience as a principal in this school. She is Caucasian and currently holds a Masters degree.

The Northeast school is a small, K-8, community, contract school serving 124 students with a staff of 19. This school has its own full time technology coordinator who serves as a temporary, substitute vice-principal on occasion. All the 8th graders have individual laptops. Staff members also have their own laptop. The school is in the process of obtaining white boards and overhead document readers. The principal claims the student-to-computer ratio is about 1:1. This school has a veteran staff. The principal holds a masters degree. He is Caucasian. He has been the principal at this school for a year, has been an administrator for 9 years, and an educator for 24 years.

The West school is medium sized, K-8, boarding school serving 380 students. Approximately 60 of the students board at the school. This school has 22 teachers and three administrators. The community is located on the outskirts of the reservation, being only 30 miles from a major town. The principal rated his school very low in technology use. Each classroom has at least a single computer and the school hosts a computer lab with 20 stations. The school is said to be ahead of the community in technology saturation and use. The principal rated his technology access as adequate. This principal is Native American but from a different tribe than his community. He holds a Masters degree and has 45 years experience as an educator, 17 years experience as an administrator, and 3 years experience at this particular school.

Themes

Using Merriam's (1998) constant comparative method, the researchers found that six major themes began to surface. First, to some degree, in each school the principal was the technology leader in the school. These leaders made technology a personal commitment as well

as a school priority. Second, the data showed that the Native American schools in the study that used technology well had adequate and flexible use of funding. However, all schools indicated challenges with funding. Third, the researchers found technology was actively being used to promote local tribal cultures in each of these four Native American schools. Forth, technology training in these Native American schools was informal and most training came from within the school itself. Fifth, each of these Native American schools expressed a need for technology coordinators. Related to this theme, was the final theme that the biggest challenge of principals is providing professional development related to technology issues.

Principals in Native American schools are technology leaders

The principal in the Northeast school brought his technology interests to the community. His background was in computer science and admits he “was always fascinated with technology.” This principal is very techno-savvy and is currently running three servers out of his house. During our interview, he mentioned he had a cyber-dinner with his wife who was vacationing in the Caribbean. This attitude of virtual experiences was further expressed when he said, “I just think that if we cannot get our kids to New York City physically, we can get them there academically” through virtual means.

The principal in the Midwest noted that although her school was currently housed in modular buildings, she was actively working to ensure her school was not left behind in the digital divide.

All of our [technology] planning has been in stages and our decisions have been effected by our modular setting...Sometimes I feel we have pretty good [technology] plan but I feel we had to do it kind of piecemeal.

For this principal, obstacles were at times quite an impediment for technology leadership. But as she mentioned, she and the school made a commitment to technology and these instances were

simply challenges, not setbacks. Her leadership was further demonstrated in adopting and investing in PowerSchool, a web-based student information system. This tool allows parents to access students' grades, attendance, etc., on a daily basis. The principal decided to reinvest in a new student information system and do away with the existing Administrator's Plus due to PowerSchool's accessibility, stability, and cross-platform usability.

The principal in the South school held a PhD in childhood development, but focused his graduate work on computer-aided learning. His technology leadership was demonstrated when asked to compare his school with the state's public schools in regards to technology use and access. He claims he was doing much better than most schools but the determining factor in his state was the commitment of the principal to make technology a priority.

In the one school where technology use was at its lowest, the principal noted that it was due to bureaucratic limitations versus limitations on his leadership vision. In regards to technology use and access, the West principal noted, "we are not quite equitable to the surrounding facilities.... [In regard to] the rapid change of technology, we have trouble keeping up." However in rating how well his school is using technology, this principal stated, "we have a way to go as far as my vision is concerned." Here, this principal expressed a vision of technology leadership, but was limited by political will as well as funding. The issue of funding is explored in detail below.

Funding sources dramatically influences technology use and acceptance

Research contradicts if increased spending directly increases student outcomes. Early research indicates there is no connection between added spending and student achievement (Hanushek, 1998). More recent research indicates that how schools spend their funds does impact student learning (Hedges and Greenwald, 1996; National Research Council, 1999).

Anderson and Becker (2001) point out that it is difficult to ascertain how spending in particular areas such as technology impacts student outcomes. Nonetheless, policy makers such as the President's Committee on Advisors on Science and Technology & Panel on Educational Technology (1997) continue to recommend increasing public spending on technology: in some cases as much three-fold. Anderson and Becker (2001) found inequity in how increased technology spending impacts different communities.

Schools serving communities with poverty and high mobility may not be able to develop 'exceptional financing methods' such as corporate donations and parent fund-raising activities. Moreover, the schools with the greatest needs are the ones whose students are least likely to have access to computers and the Internet at home. (p. 3)

The issue of 'exceptional financing methods' was investigated in this study. No principal in the study indicated the ability of tapping into corporate donations. Additionally, the research agreed with Anderson and Becker's (2001) assessment that household access in these Native American communities was reported to be non-existent or extremely low.

Technology access itself was not an issue in any of the four Native American schools. Each school mentioned that their access was adequate. In each of these cases, the schools served as the technology center for their community. In 3 out of the 4 schools, the principals ranked the schools as being technologically richer than their state run public school counterparts. Funding, however, was predominantly reported as big issue. The BIA governed school in the West felt constrained in the school's ability to react to the rapid changes and challenges of technology development. The West school was the only BIA governed school in the study. This principal mentioned how grant schools had more liberalities with their monies. In contrast to the public schools in the area, the principal indicated extreme inequity. Being on the boarder, this school

competes with the state run school down the road for Native American students. The public school, however, gets increased aid through Impact Aid for every Native American student they serve. Whereas the BIA school gets a flat rate per child without the added funding.

With Impact Aid, they can do just about whatever they want with the money. It is not sanctioned or designated. If they want, they can probably use all the money on technology...I see this as one area that we cannot come close to competing with as far as provisions for technology.

The principal in the West school said his biggest challenge was procurement. "A public school or grant school can write a check. Their money is in a nearby bank. They can write a check for whatever they need. This is one of the hindrances because we have to go through the federal tracking system." This principal noted, "funding wise, we got a ways to go. I think somewhere, at some point in time whoever makes those [technology funding] decisions has to put that into the funding formula." This principal expressed his frustration at the pittance he can spend per year on technology. Using Title I funds, he can spend \$16,000 on technology related expenses.

Anderson and Dexter (2001) claim technology leadership involves budgeting and spending, but it also means fund raising as well. "Sometimes the only way to support the costs of technology innovation is through external funding, which implies planning and writing grant proposals" (p. 5). Our study supports this assertion. The principal in the Northeast school demonstrated his leadership through his ability to raise much needed technology funds.

We have gone out and sought some grants and have done a lot with grants. The one thing that I have noticed here versus the public sector is that I have tremendous access to opportunities here if we want to do the work. We get the financial resources necessary to not only put in the infrastructure, but also for the training and upkeep.

This school principal has tapped into Indian student grants, Title VII, Title III, and bilingual funds. After recently completing a grant for \$250,000 for technology professional training, this principal goes on to say:

I think there are a number of grants that are available to Native students and indigenous people that public schools would never have access to. I think the financial situation [i.e., living below the poverty line] of many of the families of our kids open up some venues that we would not have had. We make good use of e-rate money as well... I have never had the amount of funding or the ability to operate programs that we do here.

The principal in the South agrees that funding options and autonomy greatly impacts technology leadership in Native American schools. In regards to technology and funding, he says, "I think we are doing rather well ... we have more flexibility maybe in how we spend our funds than public schools." The importance of budget autonomy and flexibility in regards to technology is supported in the literature. In looking at a report by the Pelavin Research Institute, Anderson and Dexter (2000) found, "school technology should be in a separate budget category because of unusually high start-up costs and on-going requirements for professional development" (p. 5).

Being proactive seemed to really help with technology adoption. The Midwest school had a technology plan that is reviewed every five years. This school made the commitment to set aside part of the budget for technology. This school is also pretty creative. The principal noted they don't throw anything away. They are currently using 12 years old dinosaur Macintosh LC575s as dissections projects to understand the internal workings of a computer. 8th grade students leave this school knowing how to take apart computers and knowing how to upgrade the hardware of a computer. Further this school accepts any and all donations like a recent one from the state's Department of Justice that donated all of their old computers to the school.

The Midwest principal also noted the advantages of being a grant school when it came to technology funding. “Since we are a grant school, we have some leeway. I will just be honest with you. The Bureau [BIA] as a whole has not been able to keep up. We have moved ahead of them because we cannot wait for them.”

Tribes are embracing digital technology to preserve language and culture

When asked if technology is eroding traditional values, the West principal noted,

In the absence of technology, we only had textbooks and pictures. Now, with the onset of technology there is a vast array of presentations that we can draw from, not just texts and visual displays, it is right at our fingertips anymore.

The principal in the Northeast noted:

I have an editing studio next door here in the building...we are housing [tribal records] for the entire county. I have a tribal member here, who works with our after school program helping kids with editing. Right now they are taking the archives of some of the older people here who have been videotaping here and have been here since the 1960s and we are cutting that onto DVDs so that the tribe will be able to use that on the local access channel or to even show that to other tribal members. There is a lot of history here in this old format that we are trying to put into something that will be more solvent over time. Our kids are doing that.

This principal also discussed an enlightening story of how what this school is doing today to preserve local culture.

I had a woman in here the other day and [she] wanted a copy of something because her father was doing a tribal dance and he has been dead for years. Her son saw it in school and thought ‘that is my grandfather.’ He never saw his grandfather before. So we made her a copy... That is going to promote tribal culture; it is not going to negate the culture.

The principal in the South school noted changes in the focus of education through the use of technology. Elders are using technology to research and present culturally relevant materials. The school is also beginning an e-pals program with Ireland next year. Additionally, the school has started an environmental program with Costa Rica. A delegation from the tribe was sent to Costa Rica to learn about environmental issues and cultural preservation. Through this project,

the tribe is using this connection along with technology to develop sustainable cane farming and fish hatcheries on the reservation. The school is also involved in the Globe Program where students take weekly samples of water, air, and soil. The students take the data and upload it into a global database, and thus contribute to a global earth project via technology. This school is working with tradition values, but on a global scale.

The principal in the Midwest noted the importance of non-Native Americans working with cultural informants to use technology in culturally appropriate ways. “There are simulation software programs that allow us to do things that have been culturally prohibitive, maybe dissecting animals.” Additionally, this principal noted the importance of intertribal communications as a means for the staff and students to share cultural experiences as being an important asset of technology.

Discussing the local community college’s language project, the Midwest principal noted the necessity of using technology to preserve language and culture.

There are not enough of the [native language speakers] to go into the schools and teach. Yes, I think that technology is going to have a huge impact on preserving language, to taking an oral tradition and an oral history and getting it down in a culturally relevant manner. One of the big issues has been, how do you write a book, how do you get this stuff written down? Well, if you can video it [or digitally save it], if you can preserve it that way, it is more appropriate to an oral culture ...and having that elder caught on file and having that speaker who may not be with us [much longer] will continue to teach children 20 years down the road.

The opinions expressed by the principals in this study, mirror those of many previous studies (Allen, et al., 1999; Allen, et al., 2003; Gordon, 2003). The literature is rich with technology projects aimed to revitalize Native American language and technology projects aimed to reinforce tribal cultures. A prime example is the Four Directions project that aims to “use technology’s power to revitalize and preserve, rather than destroy, American Indian cultures” (Allen, et al., 2002, p. 50). “Tribes still struggle with the legacy of poverty, neglect

and abuse, which sometimes overshadows technology planning and development. But tribal leaders often bring a careful and balanced perspective to their adoption of technology” (Gordon, et al., 2003, p. 423). The technology leaders in this study each represented this balanced perspective. In a discussion about technology and its intersection with the local culture, the principal in the West school stated, “Assimilation? We don’t think of it as assimilation. There are traditional values within the community and within our staff, but I think we are willing to do what is best to educate children.”

Technology training is informal, but leadership comes from within

This study indicates that for these four Native American schools, technology training and technology leadership came from within the school organization. As the Midwest principal noted, technology leadership was “homegrown.” This finding is consistent with research by Mehlinger (1996) who claims that teachers drive successful technology use, not outside experts. Anderson and Dexter (2000) found research indicating “both teachers and at other times, administrators initiated technology innovation. From the point of view of a learning organization, the most important thing is that both groups share vision and work together supportively” (p. 2).

The principal in the Northeast admits to having no real formal training to be a technology leader minus his interest in computer science. Nonetheless, he has taken up many venues of personal professional development.

There is understanding technology and then there is using technology the right way. I have gone to a lot of workshops administratively on the integration of technology with learning. I also provide opportunities for my staff to do that as well. I think that is the important part here. Sometimes we have these things and teachers do not know what to do with them or how you can involve them. As an administrator, if you do not get the training yourself, you are not going to understand what is out there and what people need. I try to do that.

The principal in the South noted that most of his staffs' technology training came from state mandates to obtain a given number of technology credits per year. These credits are usually obtained through in-service training provided by their technology coordinators.

A challenge noted by the principal in the Midwest school was funding a full-time technology coordinator. Instead, this school had decided to "grow our own here" stating that "because we are small, we wear many hats."

It started out as a couple of teachers who were just interested and we were self-taught and did some professional development. We learned what we had to learn...we moved along with the technology. Now I have a classroom teacher who has shown an extreme desire in the technology area. He has just continued his own professional development taking courses and classes.

This issue of internally developing technology leadership is a double-edged sword. Warner (1998) states "administrators [in Native American schools] rely on the efforts of an individual in the system who chooses to add computers to their responsibility of teaching. When this individual moves, and teachers in Indian Country are among the most mobile professionals, the expertise is lost until a new expert emerges" (p. 77).

The need to funding continued professional development was noted in all of the schools. This need is supported by the literature. Anderson and Becker (2001) state:

The widespread consensus among those in government and research who have been studying computer use in education is that effective use of educational technology depends most strongly on the human element—on having teachers and support personnel who have not only technical skills in using computers but practical pedagogical knowledge about designing computer activities that create intellectually powerful learning environments for students. (p. 3)

Native American schools need technology coordinators

Each of the schools mentioned that a big challenge in their school revolved around a technology coordinator. The Midwest principal mentioned that the greatest challenge she faced

was affording a separate technology coordinator. Over the past years, she has had to serve the dual role as principal and technology coordinator.

It was very challenging as a principal and all the things that a principal is responsible for to be the one troubleshooting computers, loading software, determining what kinds of hardware to purchase, and writing the technology plan pretty much by myself.

The principal of the West school mentioned, “we are limited a lot by not having the technical service that we need. A lot of our computers may sit idle unless we ask a consultant or technician to come in and that is quite expensive.” In the Northeast school where a technology coordinator was available, amazing technology use was found and was being efficiently used including giving laptops to each 8th grader a computer to student ratio of 1:1.

The fact that teachers need technology support to effectively incorporate technology in the classroom has been noted by numerous studies (Blomeyer 1991; Collis & Carleer 1992; Diem 1986; Garner & Gillingham 1996; Ginsberg & McCormick 1998; Means & Olson 1995; Pisapia, 1993; Ruopp et al. 1993; Sandholtz et al. 1997; Schofield 1995; Smith & Pohland 1991; Stake 1991; Strudler 1991). The results of this study mirror those in a national survey conducted Ronnkvist et al. (2000) that indicated higher or average SES communities tend to have more technical and instructional support available to them in regards to technology. In this study, the four Native American reservation schools were equally impoverished, but the school principals who had better access to funds to support technology offered their teachers more technical support. In turn, these better technologically supported schools, were using technology better and more innovatively.

Biggest challenge: Professional development of staff

The principal in the West noted that the school community was generally technologically literate poor and that inability was also found in the school. His challenge was that the school

was amassing huge inventories of technology along with the infrastructure, but he felt “we are limited a lot by not having the technical support that we need.” This school was using outdated technology because the BIA funding formula does not include technology updates.

The principal in the West expressed concern about his staff’s ability. “You have to realize our staff would have difficulty mastering the technology skills at an 8th grade level. Do you see what I am saying? We are still in the formative stages of building technology.” Additionally, he goes on to say “it is a pragmatic use of technology: to practice to be able to use it. We don’t have any formal training...we don’t teach technology per se...as we learn [technology skills] we teach the children. It is a slow process.” The principal in the South noted that his biggest challenge was getting all the staff to use technology. “Some staff is more technologically literate. Sometimes this is based on age. New teachers in [state] are required to take courses in technology and develop a technology portfolio.”

The principal in the Northeast discussed his frustrations with staff not willing to learn how to make good use of the technology available to them.

You can only beat a horse so many times. I guess that is the frustrating part...If we get this school reform grant...we are going to be looking at doing electronic portfolios and things of that nature. We have people here that I think we are going to be pulling them. They are not going to be jumping on with us we are going to have to drag them with us. I think that is a frustration. They are good teachers; they are good people. I think that is the hard thing for administrators. Especially in veteran schools with older people who do not like to see change. I think it is something we just have to keep working on. If we go to electronic portfolios they are going to have to. We have gone to electronic grading. That was a challenge for some people.

This principal noted that persistence and training was the only way to effectively facilitate technological change. In regards to implementing electronic grading, he mentioned: “we did training after training and had people he [the technology coordinator] had to sit down and actually do it” with them individually. In a national study, Ronnkvist et al. (2000) found that the

technology coordinator was instrumental in providing impromptu, one-on-one help, and professional development workshops or in-service training for teachers. The value of this variety of training was highly stressed by each principal in the study.

Conclusion

The researchers note that this study has many limitations. Although not an intention of the research, the main limitation is the ability to generalize results to other Native American schools. Since this study was small, we were unable to explore the relationship between casino funding and technology leadership simply because the issue did not arise. Another unfortunate limitation is that this study represents four schools on four reservations. Native American reservation schools are extremely diverse and a variety of cultural values will be found in each tribe. Further, state relationships with the tribal governments may be an important factor in technology leadership. This relationship varies from state to state. These issues are worthy of further research.

In a 1998 national survey, Ronkvist et al. (2000) took a national probability sample of principals, tech coordinators, and teachers in US schools. These researchers found the average student to computer ratio was 6:1. The data from this small study indicates that our sample either had fantastic technology saturation, or technology saturation near 1998 national levels. In those schools that had sufficient technology saturation, funding options seems to be instrumental in technology leadership.

In their study, Anderson and Becker (2001) found that the digital divide is widest in the area of technology support. They go on to say “this finding suggests that not only does this lower the capacity of poorer schools to utilize the technology that they do have, but they are less likely to be able to evaluate and adapt to new technologies as they emerge in the future” (p. 19). This

reality was seen in this study. Professional development, which includes access to a competent technology coordinator, was seen as a top priority.

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